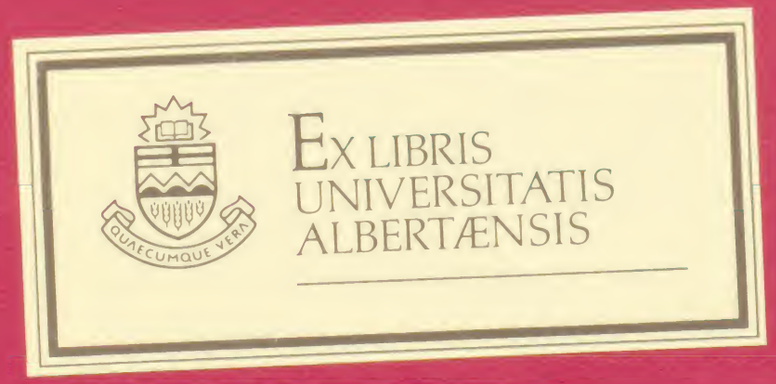
Junior High School

Curriculum Guide

for

INDUSTRIAL ARTS

DEPARTMENT OF EDUCATION
EDMONTON, ALBERTA
SEPTEMBER 1969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The Department of Education acknowledges with appreciation the contributions of the members of the Junior High School Ad Hoc Committee on Indust ial Arts to this Guide. The Committee operated under the direction of the Secondary School Industrial Arts Curriculum Committee and the Secondary School Curriculum Board.

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NOTE

This Curriculum Guide is a service publication only. The official statement concerning the course is contained in the Junior High School Program of Studies. The information contained in the Guide is prescriptive insofar as it duplicates that contained in the Program of Studies. The Guide, however, contains as well as content, methods of developing the concepts, suggestions for the use of teaching aids and additional reference books.

I. INTRODUCTION

Technology is one of the major forces influencing society today. It has revolutionized industry and is now breaking down the walls of the schools through the introduction of television, video tapes and tape recorders. Everyone is affected to some extent by changes in technology.

It is imperative, therefore, that man learn to understand the changes and the forces at work in order that he might be better able to channel them to his advantage Industrial arts provides ways for the student through its content, organizational pattern and activities to confront some of the technological problems inherent to our productive society.

II CONTEMPORARY THOUGHT IN INDUSTRIAL ARTS EDUCATION

Bonsor and Mossman indicated the purpose of industrial arts when they formulated a definition of this subject area over forty years ago. Their definition has been the most widely quoted one in the history of industrial arts.

> "The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values and of the problems of life related to these changes."[1]

In 1957, Hornbake made the following statement:

> "The acceptance of industrial arts into the family of school disciplines assumes that the world of work, particularly the phenomena of industry, constitutes a legitimate area of study. Can a person who lives in an industrial democracy lay claim to being an educated person if he has not become aware of the basic processes by which society maintains itselt."[2]

Hostetler and Young, Professors of Industrial Arts at North Carolina State College stated:

> "If we over simplify the total task of education and agree that the central purpose of education is to enable the student to solve all of his problems (emotional, social, communicative, vocational, etc.) we would then say that the purpose of industrial

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[1]F. Bonsor and L. Mossman, *Industrial Arts for Elementary Schools* (New York: Macmillan Co., 1924), pp. 3-18.

[2]L. Hornbake, "Philosophical Viewpoints", American Council on Industrial Arts Teacher Education, *A Sourcebook of Readings on Education*, 6th Yearbook (Bloomington, Illinois: McKnight & McKnight Publ. Co., 1957), pp. 14-15.

arts is to provide experiences which will enable the student to solve the technical problems of living in a highly industrial age. The experiences provided should give the student an opportunity to apply science, mathematics, and other facets of his general education to the solution of practical problems in the industrial arts shop. Industrial arts is the general education aspect of the industrial education complex. It is general education in that it is not specialized. These experiences are not those which prepare for a trade or vocation, but are designed to familiarize the student not only with materials, processes and tools of industry but also with industry as science and invention - as a means of producing goods and services - and as a unique pattern of human relationships. Industrial arts is designed to provide general orientation and basic skills and experiences which may become a basis for making vocational decisions and for further study in the industrial-technical complex."[3]

Feirer, editor of the Industrial Arts and Vocational Education Magazine, made the following statements with regard to the purpose of industrial arts:

> "A good industrial arts program affords students an insight into American Industry, the source of raw materials, how basic materials are processed, how products are designed and produced, and how people earn a living."

A summary of the few statements quoted above and of industrial arts literature in general illustrates that there appears to be consensus on the following points:

a) Industrial arts education is a part of general education.

b) Industrial arts education is concerned with interpreting the world of work, with industry a salient component, to all youth.

III. FUNCTIONS OF THE JUNIOR HIGH SCHOOL

The Department of Education in Alberta has stated specific functions for the junior high school which are in addition to the functional objectives of secondary education. It is important, therefore, that teachers of industrial arts interpret the junior high school industrial arts program to the achievement of the functions of the junior high school. For this reason they are included below:

1. To provide a setting in which the adolescent is understood and one in which he might experience success. This contributes to a positive concept of self and others.

2. To continue the development in the basic skills and knowledge begun in the elementary school and to broaden the educational program to include more opportunities for students to think critically and to draw generalizations.

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[3] I. Hostetler and T. B. Young, *A Guide to Curriculum Study - Industrial Arts* (Raleigh, North Carolina: State Board of Education, 1959), p. 3.

3. To provide a breadth of curricular offerings suited to the interests and needs of twelve- to fifteen-year-old youth and to permit, herever feasible, student selection of educational experiences.

4. To provide for the mental, physical and aesthetic needs of students and to develop talents in these areas.

5. To provide opportunities within the curriculum and extra-curricularly for the development of acceptable social, moral and spiritual values.

6. To help pupils discover special interests and abilities that will enable them to set realistic educational and vocational goals.

7. To prepare the student to live successfully in a changing world.

IV. OBJECTIVES OF THE INDUSTRIAL ARTS PROGRAM

Industrial arts has a unique place to fill in an education program that has as its objective the development of an informed citizenry in a highly industrialized society - a society that must learn to use and control the technologies. Schools must help prepare people to manage an industrial complex unknown before and to work in vocations not yet described. Industrial arts is a subject area the scope of which introduces students, both boys and girls, to all aspects of productive society and has the following objectives:

1. To provide exploratory experiences in various technologies prevalent in a productive society.

2. To provide a synthesizing evnironment for students to apply their academic knowledge in the solution of practical problems.

3. To provide a supplementary guidance function by introducing the students to the multiplicity and interrelationship of educational and occupational opportunities.

4. To provide an environment which stimulates the individuals to discover and develop their interests and talents.

5. To develop attitudes of safety with a respect for safe working habits and practices in the use of tools, equipment and materials.

6. To develop attitudes of personal and social responsibility.

7. To have students develop an organized conceptual frame of reference interrelating the knowledge of the various technologies prevalent in a productive society.

V. DEFINITION OF TERMS

The following is a definition of terms used with the industrial arts program:

1. Multiple-Activity Laboratory - A laboratory where three or more activities are in progress at the same time.

2. Field of Study - Field is the general title given to the basic technologies represented, e.g., materials, electronics.

3. Unit - A unit consists of from nine to twelve weeks of work in a field. There may be several units to complete a field, e.g., woods, metals, plastics, earths in the materials field.

4. Predesigned Products - Students at the junior high school level may not have the background or knowledge of tools and materials to design their own products. The teacher should exercise care in the designing of projects to best meet the objectives of the course.

5. Instruction Sheets - These are supplemental teaching materials which contain organized material for the use of individual students. There are four common types:

   a) Operation Sheet - gives directions on how to perform a single manipulative task. This would include the directions or how to operate a machine.

   b) Job Sheet - gives directions on how to do, completely and in proper sequence, a number of operations. The procedure for making a product or doing an experiment would consitiute a job sheet.

   c) Information Sheet - contains everything necessary for the understanding of an instructional unit which is largely informational in nature.

   d) Assignment Sheet - directs the study to be done by the student on a lesson topic, and may include questions to determine how well a lesson has been learned.

6. Student Manual - The manual outlines in detail specific activities and assignments students are to do. This is a "guide" for the student to follow. It includes instructions to read specified pages in reference books, to view a filmstrip, to work out given problems and/or to outline the procedure for an activity.

7. Sequential Pictorial Instruction Books - S.P.I. books provide a sequence of pictures that illustrate the sequential procedures to be followed in performing a specific operation or process.

VI. THE MULTIPLE-ACTIVITY PROGRAM

The multiple-activity program is an organizational device by means of which a variety of exploratory experiences can be presented with a minimum of room and equipment. The laboratory is organized into a number of different sections representing the fields of study. Each section or bay is large enough to accommodate 4 to 6 students. These bays are as self-contained as possible with provisions made for the storage of tools, products and stock within them. The class is divided into three or more groups with each group working through the course unit in the assigned bay. After the completion of the unit in from nine to twelve weeks the groups rotate, each proceeding to another bay and new experiences.

As the units consist of from nine to twelve weeks of work, depending on the number of areas in operation, there will be several weeks unaccounted for. This time, two to four weeks, could be used at the beginning of the year to organize the activities of the groups, plan the first product for an area, teach the beginning

lessons of each unit, give demonstrations, and provide the information required to get each group started efficiently in their assigned unit.

Poor management and lack of planning are bound to result in confusion. Therefore, the teacher must have a well-devised plan before attempting to operate a multiple-activity laboratory.

1. Fields of Study

To provide for a breadth of exploratory experiences the junior high school industrial arts program is divided into six fields of study. These fields are further subdivided into thirteen units. Each unit represents nine to twelve weeks of study. The minimum number of units studied in one year is three. During the junior high school years it is recommended that a student study a minimum of three different units each year. In junior high schools where industrial arts is taught only two years, it is recommended that four different units per year should be studied.

Fields of Study	Units
a) Power	one
b) Materials	
(1) Woods	one
(2) Metals	one
(3) Plastics	one
(4) Earths	one
c) Electronics	
(1) Electricity	one
(2) Electronics-Computer	one
d) Graphics	
(1) Visual Communications	one
(2) Graphic Communications	one
e) Industrial Crafts (choose one only in Junior High)	
(1) Leather	one
(2) Lapidary	one
(3) Art Metal	one
f) Developmental Research (see page 97)	one

In addition to the six fields outlined, the junior high school industrial arts program includes a testing area and an instructional materials center. The testing area utilizes the materials and some of the products made in the other areas. The instructional materials center is used as a students' resource room, conference room and research area. The Developmental Research Unit is to be used for teacher research into new content only. The teacher must define the content of this unit and obtain the approval of the Provincial Supervisor of Industrial Arts and his principal before introducing it to the students.

2. Length of Program

The recommended time is from 4800 - 7000 minutes per year or 120-175 minutes per week in two blocks of time.

3. Organization of Industrial Arts Laboratories

The industrial arts area is designed as a multiple-activity laboratory. Each school should have all the fields of instruction represented, either in one or more facilities.

Each of the work stations should be self-contained with regard to tools, machines and materials. Enough floor area should be provided to accommodate from four to six students per station.

As the laboratory work proceeds, small groups of four to six students would be found pursuing activities at three or four of the stations. Following the completion of the outlined learning experiences in a unit, the group proceeds to the next station and engages in study and activities related to it.

This system of rotation insures each student an introduction to all the components of the program.

A multiple-activity laboratory affords each student the opportunity to observe the interdependence of technologies and to visualize the basic tools, machines, and processes in each of the technologies.

4. Approach

The use of the product in industrial arts has merit. It is to be considered a vehicle for learning. When the product becomes the focal point and ceases to be a media for this learning experience it should be reevaluated. Carefully selected products are recommended for some of the units included in this program. The woods, metals and plastics units lend themselves well to the product method. The products, however, should be predesigned and permit a measure of successful achievement for all levels of learning. Units such as electricity, electronics, computer technology, and power mechanics, lend themselves well to an experimental approach. Predesigned and programmed laboratory exercises will assist in the degree of student understandings. The teacher should have available instructional materials of all types such as workbooks, S.P.I.'s, films, slides, and manuals. These would help him and the students organize their time efficiently. Test-stand experiments will assist both in the understanding of these areas and in developing an appreciation for the scientific method.

5. Suggested Organization of Teaching Units

a) Three-Year Program

Grade VI	Grade VIII	Grade IX
Electricity	Visual Comm.	Electronics - Computer
Plastics	Woods	Power
Earths	Metals	Graphic Comm.

b) Two-Year Program

First Year	Second Year
Woods	Electricity-Electronics-Computer
Metals	Visual Comm.
Plastics	Graphic Comm.
Earths	Power

(A Developmental Research and/or craft unit may be used as a "floater" for enrichment.)

6. Scope of Program

The scope of the industrial arts program includes all the major technologies and all students, both boys

and girls should have the opportunity to explore the fields.

VII. HOW TO USE THE GUIDE

This guide is written so that teachers can more specifically relate the content to be taught to the major concepts of industrial arts. Each topic is followed by a concept that the students should understand at the completion of their activities.

The concept is further subdivided into statements which help define the content, the processes and/or the activities in which the students will engage.

Useful instructional media suggestions are listed in the last column.

The procedure for teaching the units may vary with the teacher. However, the following guidelines will be useful to ascertain adequate coverage of the topics.

1. The unit is divided into a number of topics. The amount of time spent on each will vary with the content to be studied. The order in which the topics are covered may also vary.

2. Each topic is circumscribed by one or two concepts. The material to be studied is selected on the basis that it will help the student understand the concept.

3. Conceptual statements are used to define specific points related to the concept. These statements are inserted in the column that lists the systems or processes.

4. The activities are suggestive and provide direction as to types of things in which students may engage. The following are categories of activities students should experience:

Adjusting	Describing	Operating
Analyzing	Designing	Organizing
Computing	Developing	Planning
Constructing	Displaying	Processing
Controlling	Examining	Reading
Cooperating	Installing	Researching
Creating	Interpreting	Scheduling
Defining	Inventing	Studying
Demonstrating	Judging	Testing
Depicting	Observing	

5. The guide will provide a logical sequence of progression in the development of the concepts listed. The teacher will need instructional materials for student use. These include:

   a) Manuals - outlining assignments of experiments, reading, products
   b) Tapes - describing use of specific instruments, experiments or procedures
   c) Loop films
   d) Slides
   e) Filmstrips
   f) Charts
   g) Models
   h) Films
   i) Programmed instructions.

6. The testing and guidance topics or portions thereof should be developed under the topics in which the subjects may be appropriately handled.

7. Information topics could be covered by

-Reading
-Researching
-Films
-Tapes
-Seminars
-Discussions
-Resource people
-Tours
-Assignments
-Writing for information

8. A plan for the year should be prepared. In it the units to be taught each grade should be listed and a time schedule developed.

9. The teacher should have a master plan book that outlines his program for each unit. It should include:

a) An outline of how each topic is to be presented

-demonstrations
-student assignments •reading
•experiments
•products
•films to view
•tapes to hear

-evaluation procedures
-criteria for marking practical work such as products and experiments
-tests and quizzes given.

b) All the instruction materials given to students should be in the master book.

10. A student personnel system under the direction of the teacher should be planned to allow students to make decisions and assume responsibility.

11. A daily plan is necessary. It outlines specifically the materials to be taught to each class in advance of the lesson period. Follow-up of the period should also be noted.

VIII. THE SAFETY PROGRAM

Every industrial arts laboratory must have an effective safety program. This does not mean that the promulgation of a set of rules and regulations will satisfy this end. Students must be taught in each and every subject studied within the industrial arts framework, the "hows and whys" inherent in the safety program. It is the responsibility of the teacher to supply continuous and vigilant supervision and to ensure that all students engage in only safe laboratory practices. A good safety program would include:

1. Machine guards and operating procedures approved or recommended by the Workmen's Compensation Board.

2. Regular and thorough instruction and revision.

3. Constant vigilance.

4. Checking and evaluating of student safety habits by the teacher.

5. Complete first aid equipment kept in first-class condition.

6. Non-skid material and clearly marked working areas around all machinery.

7. Proper clothing with particular attention to eye protection.

8. Machines and tools in good working condition.

9. Routine reporting and recording of all accidents.

10. Good housekeeping.

The following are samples of safety regulations which the teacher might be expected to enforce:

1. No power machines shall be used by any student before specific instruction has been given with regard to safe operation and safety precautions.

2. No power machine shall be used while the instructor is absent from the laboratory.

3. A student shall not use a machine unless it is equipped with approved guards.

4. Approved eye protection must be worn for certain operations.

NOTE: A good safety slogan which should be put into practice at all times - a place for everything and everything in its place.

There are six basic steps in safety education:

1. Be familiar with Workmen's Compensation Regulations.

2. Set a good safety example for students.

3. Instruct each student thoroughly in the safety precautions of his job.

4. Keep all tools sharp and in good condition.

5. Keep all safety devices in proper use.

6. Follow up safety instructions constantly. The laboratory will be as safe as the teacher makes it.

Dress and deportment play an important part in the operation of a safe program. Students and teacher should be neatly dressed at all times and the teacher should take care to ensure that no loose and dangerous clothing is worn. Safety aprons, goggles, gloves and face shields should be used wherever necessary.

Each school should receive the excellent publications and bulletins dealing with accident prevention and safety procedures distributed by the Workmen's Compensation Board, Edmonton, Alberta.

NOTE: Accidents must be promptly reported to some senior school authority. If no other person is designated, this authority is the Principal.

IX. GENERAL INFORMATION

1. Records

Every teacher should keep the following records.

a) Attendance

b) Daily plan (activities, demonstrations, follow-up.

c) Phase plan for the year

d) Record of student achievement (test marks, product rating, etc.)

e) Inventory of equipment and supplies

f) Student personnel system

g) Any other records that are deemed desirable

2. Student Evaluation

As the industrial arts courses are exploratory it is not logical to have students repeat units. A profile chart should be part of the student's report to show his standing in the various units he has studied.

3. Size of Classes

Courses and accommodation are prepared on the basis of a maximum class size of sixteen to twenty pupils per teacher.

4. Laboratory Accommodation and Equipment

An Industrial Arts Laboratory Planning Manual is available from the Department of Education, Stationery and Supplies Branch, Room 712, Administration Building, Edmonton. (Price: $1.00)

An Industrial Arts Equipment List is available from the Supervisor of Industrial Arts, Dept. of Education, Room 808, Adminstration Building, Edmonton. (No Charge)

5. School Opening

Several days to a week should be spent at the school preparing the program prior to opening day. The following points should be checked:

a) Examine the inventory - all tools should be repaired, sharpened, and properly stored.

b) Go over materials on hand - there should be material on hand to provide for the first rotation.

c) Plan your year's program - prepare a broad outline of the year's work in each grade. Have dates set for the time of rotation, when the groups change their activities.

d) Have the lessons in each area outlined with information, job sheets, etc., available to get started.

e) Have the products selected for each area in which they are required

f) Have a record system prepared.

g) Survey product storage space and have lockers assigned by classes. Specific lockers can be given to students later.

h) Have a general information sheet prepared for each student, outlining general laboratory procedures and rules, fees required, evaluation criteria, and other information you find pertinent.

i) If your system has a book rental scheme, make arrangements to have the initial laboratory fee collected by the book rental secretary.

j) Have the laboratory thoroughly cleaned, painting done where needed, and laboratory coats and aprons clean.

k) Examine fire prevention equipment to see that it is functional.

l) Develop a complete and comprehensive safety program (charts, regulations, safety zones, etc.)

6. Laboratory Closing

At the end of the school year the teacher must ensure that:

a) The inventory is checked and reported to the Principal or Secretary-Treasurer.

b) The students' accounts are audited by a responsible authority, usually the Principal.

c) The tools are sharpened and needed repairs are ordered.

d) The tools are either oiled or waxed and put in a secure location.

e) The laboratory is thoroughly cleaned and left in creditable condition.

f) The materials that will be needed in the first quarter of the next term are ordered.

g) An inventory of instructional materials is taken and sufficient preparation is made to get started in the fall.

h) Rag bins and paint room supplies are checked. (Discard all soiled rags.)

i) Batteries are removed from electronic equipment, meters, etc.

j) Student lockers are cleaned out.

7. Provision for Custodial Services

Daily complete caretaking services are required to keep an industrial arts laboratory functional and allow maximum time for instructional purposes.

FORMAT EXPLANATION

Topic -Major topic to be developed
Concept -Major concept to be developed

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Major Systems and Processes to be studied. -Sub-systems and processes to be studied. -Sub-concepts The systems or processes as outlined are to be considered required content.	This area should be completed by the teacher as guidance in laying out the unit of instruction.	Suggestions of what the student can do to develop an understanding of the topic, concept, system or process, sub-system or process, and sub-concepts. This area should be continually updated and added to by the teacher as better ways for teaching the systems and processes become apparent.	Suggestions of media to be used to assist the student in developing an understanding of topic, concept, system or process, sub-system or process, and sub-concepts. This area should be continually added to and updated by the teacher. Code for Media: ▶< Films B Filmstrips [] Transparencies or Slides o—o Tapes ▶<^{8} Film Loop

P O W E R

INTRODUCTION

This course is an introduction to the study of the sources, transmission, operation, control, and application of power. A concept of work, energy, and power should emerge through the reading and activities in which the student will engage as he progresses through the area.

Testing and analysis make up the core of the program. Facilities and equipment must be provided so that the program can achieve the expected results.

SPECIFIC OBJECTIVES

1. To help the student understand the many basic concepts and principles of science at work in power and relate these concepts to the vast area of power technology.

2. To gain knowledge of the utilization, transmission, and control of power.

3. To familiarize the student with the basic construction, operation, application, care, and control of machines that convert power to useful work.

4. To develop problem-solving techniques related to machines and their operation, control, analysis, and application.

5. To learn safe practices in the power area.

SUGGESTED APPROACH

The general approach in the course is that a student studies the total system, e.g., two- and four-stroke cycle gasoline engines, simple mechanical transmission systems, and simple hydraulic and/or pneumatic systems. The emphasis in the junior high school program should be at the systems level, with the units and components introduced only where and when necessary for clarification purposes.

The study should revolve around three basic topics:

a) Principles of operation
b) Control and analysis
c) Application.

When a, b, and c are applied to the study of a total system, an organized and systematic program can be presented.

The power area should focus on the application of scientific concepts in technology. Parallels of the utilization of scientific concepts should be drawn between their use in power technology and other technologies whenever possible. Terms and practices used should be explained scientifically and also as they apply to other technologies.

COURSE CONTENT

Topic A. -Power Sources
Concept: -The conversion and application of energy is basic to a productive society.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Direct Mechanical Converters -Muscular, water, wind		It is suggested that all the systems under Topic A be studied on a comparative basis under the headings: a) Principles of Operation b) Control and Analysis c) Application d) Safety	
2. External Combustion Converters -Steam Engine			Model of a steam engine
-Steam Turbines			Job sheet on constructing a steam turbine
-Fossil Fuel Generators			
-Atomic Fuel Steam Generators			Atomic Energy of Canada Limited, Pinawa, Manitoba
3. Internal Combustion Converters (Heat Engines) -Piston or Reciprocating			Films: ▸< *Introduction to the Heat Engine*, (Shell Oil) ▸< *ABC of the Automobile Engine* ▸< *ABC of Internal Combustion* ▸< *ABC of the Diesel* (General Motors Corporation) ▸< *Diesel Story* ▸< *The Engine* ▸< *The Two-Stroke Cycle Engine* (Shell Oil)

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
			Models: -Two-stroke cycle Internal Combustion Gasoline Engine -Four-stroke cycle Internal Combustion Gasoline Engine -Four-stroke cycle Internal Combustion Diesel Engine
-Rotary Combustion			Models: Wankel Rotary Combustion Engine
-Turbine			Model of turbine. Films: ▶< *The Gas Turbine*, (Shell Oil) ▶< *Gas Turbine*, (Gen. Motors Corp))
-Airstream Reaction			Model of jet. Film: ▶< *Introduction of Jet Engines*, (National Film Board)
-Rocket			Estes Industries Inc., Box 227, Penrose, Colo. 81240 Rocket Models from: Edmund's Scientific, Barrington, N. J. 08007 Other Media: Jim Handy Filmstrips & Transparencies from: McGraw-Hill Co. of Can. by Sheppard and from Delmar Publishers - Dickson
4. Electrical Converters -Conventional, e.g., AC generators, DC generators, motors, transformers -Exotic, e.g., direct converters, fuel cells, magnetohydrodynamic generators, photovoltaic converters, therionic converters, thermoelectric generators, AC from DC direct converters		-Review or introduce (Electricity Section). -Understand the tie-in with the other power sources. -Review or introduce (Electricity Section). -Understand the tie-in with other power sources.	

Topic B. -Power Systems
Concept: -How energy is applied in various power systems.

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
1. Two-Stroke Cycle Internal Combustion Engine		-Study a cutaway model, noting design, and major systems.		-Investigate design and application.	-Two-stroke cycle internal combustion model.
		-Locate and analyze the operation of the major systems.	-Analyze the controls built into each system.	-Examine the interrelationship of the systems.	-Charts of major systems - fuel, cooling, lubricating, ignition.
		-Read the operating instructions on the assigned engine. Note maintenance; how to start, how to stop.	-Read the instructions on the assigned engine, noting how to control the engine and how the controls operate.	-Discuss the necessity of proper preventive maintenance of power equipment.	-Operating instruction booklet on the assigned engines.
		-Start the assigned engine	-Adjust the controls such as the throttle and air-fuel needle, and see how they affect engine operation		-Operating instruction manual

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
Two-Stroke Cycle Internal Combustion Engine (Cont'd.)			-Using a small engine test stand, perform tests such as: •effect of air-fuel ratio on power •effect of plug selection •effect or plug gap •effect of humidity, pressure and temperature •effects of various types of fuels •effects of oil-fuel ratio •torque •R.P.M. under various conditions	-Discuss necessity of proper adjustments in order to obtain best resulty from your car •plug selection depends on use of the engine.	-Test unit instructional manual.
			-Develop concept of work, energy and power		
		-Stop the assigned engine.			

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
Two-Stroke Cycle Internal Combustion Engine (Cont'd.)		-Proper storage procedures		-Importance of following specific procedures when storing lawn mower, etc., for a long time.	
		-Know safety precautions, e.g., fuel and fuel storage •backfire •order of starting •order of stopping •heat areas •moving parts •carbon monoxide.		-Discuss proper storage of fuel at home •importance of fueling and/or running an engine in a well-ventilated area -Importance of guards.	
2. Four-Stroke Cycle Internal Combustion Engine		-Study a cutaway model, noting design and major systems.		-Investigate design and application.	-Four-stroke cycle internal combustion model.
		-Locate and analyze operation of the major systems.	-Analyze the controls built into each system.	-Examine the interrelationship of the systems.	-Charts or major systems fuel, cooling, lubricating, ingition

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
Four-Stroke Cycle Internal Combustion Engine (Cont'd.)		-Read the operating instructions on the assigned engine, noting maintenance; how to start, how to stop.	-Read the instructions on the assigned engine, noting how to control the engine and how the controls operate.	-Discuss the necessity of proper preventive maintenance of power equipment.	-Operating instruction booklet on the assigned engines
		-Start the assigned engine.	-Adjust the controls, such as the throttle and air-fuel needle, and see how they affect engine operation.		-Operating instruction manual
			-Using a small engine test stand, perform tests such as: •effect of air-fuel ratio on power •effect of plug selection •effect of plug gaps •effect of humidity, pressure and tempera-ture •effects of various typ types of fuels •effect of oil-fuel ratio •torque •R.P.M. under various conditions	-Discuss necessity of proper adjustments in order to obtain best results from your car. •plug selection depends on use of the engine	-Test unit instruction-al manual

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
Four-Stroke Cycle Internal Combustion Engine (Cont'd.)			-Develop concept of work, energy and power.		
		-Stop the assigned engine.			
		-Proper storage procedures		-Importance of following specific procedures when storing lawn mower, etc., for a long time.	
		-Know safety precautions e.g., fuel and fuel storage backfire order of starting order of stopping heat areas moving parts carbon monoxide		-Discuss proper storage of fuel at home -Importance of fueling and/or running an engine in a well-ventilated area. -Importance of guards.	
3. Comparative test Two-Stroke Cycle and Four-Stroke Cycle Engines			-Do comparative tests using two- and four-stroke cycle internal combustion engines. Graph results of H.P., R.P.M., etc.	-Know where engines are used and the reasons.	-Test unit instructional manual.

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
4. Electric Motors (Optional)		-Analyze the operation of an electric motor.	-Do comparative tests using the two- and/or four-stroke cycle internal combustion engine and an AC electric motor.	-Know application of engines and motors.	-Test stand operation instructional booklet.

Topic C. -Transmission
Concept: -Energy output can not be greater than energy input.

1. Mechanical Systems		-Use Mock-ups or cutaways to study methods of transmission, e.g., gears, belts and pulleys, chains and sprockets, shafts, fluid coupling, airstream reaction.		-Study a car •gearbox •differential •steering mechanism -Investigate other mechanical systems found in the laboratory.	-Films: Jam Handy
		-Trace power through various mechanical systems.	-Analyze and graph where possible •mechanical advantage •efficiency.		
			-Understand directional changes and control.		

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
Mechanical Systems (Cont'd.)			-Compare ratio of input to output of several mechanical systems, e.g., gearbox train.	-Operate lathe gear system and compare ratio of input to output.	
			-Compare mechanical transmission with other types of transmissions.	-Develop concepts of leverage, piston action, etc.	
2. Pneumatic		-Investigate a closed pneumatic system to ascertain how it operates.	-Understand principles of pneumatic circuits •concept of pressure and vacuum •problems in area •flow	-Analyze the vacuum, e.g., distributor model from a car or vacuum windshield wiper motor.	-Instructional manual
				-Apply concept to the vacuum-forming press	
And/Or		-Set up several circuits.		-Design and create a simple circuit using a lab machine, e.g., drill press.	

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
Pneumatic (Cont'd.)			-Compare with other types of transmissions.	-Uses of pneumatics in a productive society, e.g., climate control.	
3. Hydraulics		-Inspect a closed hydraulic system to ascertain how it operates.	-Understand principles of hydraulic circuits •concept of pressure •problems in area •flow.		-Instructional manual
		-Set up several circuits.		-Design and create a simple circuit for a lab machine, e.g., shear, press	
			-Compare with other types of transmissions.	-Uses of hydraulics in a productive society.	
4. Fluidics Systems		-Treat as an information topic until such time as equipment becomes available. -Relate to the electricity-electronics-computer units.			

Systems or Processes	Time	Student Experiences and Activities			Instructional Media
		Operation	Control and Analysis	Application	
5. Electrical Transmission Systems		-Treat as an information topic until such time as equipment becomes available. -Relate to the electricity unit.			

Topic D -Educational and Occupational Projections
Concept: -A productive society must prepare its youth to make realistic vocational choices.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Guidance			
-There are many job opportunities for highly-skilled persons.		-Investigate job opportunities in power-oriented fields. -Visit Vocational Education or technical Institute laboratories in your area.	-Pamphlets: Check with the Counselling and Guidance Office.
-Our society depends on highly-skilled labor and division of labor.		-See a film on occupations in power.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Guidance (Cont'd.) -Technologists require training beyond the high school level. -The organization and management of business enterprises is an important element in a productive society.		-Tape an interview with a mechanic and play the tape back to the class. -Prepare a job qualification list for three different occupations related to power.	

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M A T E R I A L S

INTRODUCTION

Woods, metals, plastics and earths are all extremely important materials. The student should be made aware of these by being involved in materials testing, and fabrication. This field should bring the student into contact with the more common materials, tools, equipment and processes as used by industry. Through this exposure it is hoped that the student will better understand the world in which he finds himself. A study of occupations related to the materials units will reveal the wide scope of this industrial field. There are careers in this field which have not yet been defined but which are certain to evolve in the very near future.

SPECIFIC OBJECTIVES

1. To provide the student with an opportunity to discover special aptitudes in the kinesthetic area.
2. To provide the student with an opportunity to learn to use tools safely and correctly.
3. To give the student an insight into the occupational opportunities related to materials.
4. To instill in the student an appreciation of high standards and pride in workmanship.
5. To familiarize the student with some of the fundamental material processes.

SUGGESTED APPROACH

Due to the complexity and variety of the materials field a student can not have experiences in all of the basic processes and operations involved. Therefore, much of the emphasis in materials must be on testing and on developing an understanding of the major concepts that are prevalent in industry.

While the product is still an important vehicle for student motivation and process development, more emphasis should be placed on testing and evaluating materials for the purposes to which they can be adapted.

The pattern of course development should be such that the student develops a comprehension of the concepts of materials and their place in our industrial society. How far one can develop these ideas depends upon the materials, tools, equipment, laboratory space available and the imagination and initiative of the teacher.

SAFETY

The laboratory organized for multiple activity must have an effective safety program. Machines must have adequate guards; students must be properly clothed for their work and thorough instruction in the use of ALL hand and power tools is of utmost importance. No machine should be student operated until complete instructions and demonstrations have been presented by the teacher.

C O U R S E C O N T E N T

Topic A. -The Material and Testing
Concept: -The development, testing and effective utilization of a nation'a natural and synthetic resources is necessary for a productive society.

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
1. <u>Development of natural and man-made materials</u>. -Raw materials are refined, processed and restructured to make new substances useful to man. -Man depends on many materials to meet the needs of a productive society. -Product research and development is important in a productive society.		-Interpret tree growth charts. -Investigate developments of restructured products, e.g., plywood manufacturing, process and advantages. Particle board-types, processes, uses. -Know the chemical derivatives of wood. -Know the significance of the pulp and paper industry. -Procure information on substitutes for paper and their significance.	-Fyfe Smith Charts -Fyfe Smith Charts	-Know the main raw materials used in the metals industry. -Understand reasons and desirability of alloying. -Describe significant developments in the industry.
2. <u>Sources</u> -Everyone should help to conserve out natural resources for future generations.		-Discuss: -conservation -cause of forest fires -reforestation -tree nurseries -legislation		-Discuss conservation

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
-Examples of raw materials	-Know the raw materials and understand basic principles in the production of some plastics such as polystyrene, vinyls and polyethelene. -Make some acrylic plastic. -Know and relate the plastic families. -Study significant developments in the industry.	-Film: *Perspect for Plastics* (Shell Oil) -Booklet: *ABC's of Modern Plastics* -Film: *Plastics* (Imperial Oil)	-Know about the materials used in the earths industries, e.g., cement and concrete, gypsom, clays, glass, glazes, porcelain enamels, abrasives -Study: structural clay products whiteware insulating materials	
	-Discuss conservation		-Discuss conservation	

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
Sources (Cont'd.) -Availability of raw materials affects technological development. -Sources of raw materials are widely scattered.		-Using a prepared map of Canada that outlines the raw material areas and the related manufacturing areas: a) note the location of raw materials and related manufacturing areas b) interpret the significance of: 1) their relative position to each other 2) transportation and raw materials 3) manufacturing and population 4) manufacturing and transportation 5) available occupations		-Using a prepared map of Canada that outlines the raw material areas and the related manufacturing areas: a) note the location of raw materials and related manufacturing areas b) interpret the significance of: 1) their relative position to each other 2) transportation and raw materials 3) manufacturing and population 4) manufacturing and transportation 5) available occupations
3. <u>Identification</u> -All materials can be classified under natural fibres, natural ores or synthetics.		-View cell structure of hardwoods and softwoods under a microscope. (Relate to hardness and weight.) -Note characteristics such as color, odor, texture	-Wall Charts and Samples	-View the crystal structure of metals. (Relate to hardness and weight.) -Classify metals as to ferrous and nonferrous.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
	-Using a prepared map of Canada that outlines the raw material areas and the related manufacturing areas: a) note the location of raw materials and related manufacturing areas b) interpret the significance of: 1) their relative position to each other 2) transportation and raw materials 3) manufacturing and population 4) manufacturing and transportation 5) available occupations	-Pamphlet: *Nature and Uses* Canadian Industries Limited	-Using a prepared map of Canada that outlines the raw material areas and the related manufacturing area: a) note the location of raw materials and related manufacturing areas b) interpret the significance of: 1) their relative position to each other 2) transportation and raw materials 3) manufacturing and population 4) manufacturing and transportation 5) available occupations	
-Wall Charts and Samples	-Refer to a list of the general properties of the following plastics. Thermoplastics - acetols, acrylics, cellulosics, nylons, flurocarbons, polycarbonates, polyolefins, polystyrenes, vinyls.	Film: *Kingdom of Plastics,* (General Electric)	-Characteristics, properties, and uses of common materials such as clays, cements, abrasives, glass, glazes.	Wall Charts and Samples

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
Identification (Cont'd.) -Materials have distinguishing properties and characteristics that dictate the uses to which they can be adapted.		-Identify common woods and compare their properties, uses, prices.		-Note characteristics, properties, common uses, sizes, shapes of readily available metals.
4. <u>Testing</u> -Testing of materials is an important function of manufacturing. -Properties of materials can be changed chemically and/or physically.		-Compare wood to other natural and synthetic materials. -Comparative test wood samples for properties such as weight, strength, hardness, elasticity. -Relate the structure of the material to its workability. -Note the effect of chemicals on wood, e.g., bleaching.		-Spark test for carbon content. -Comparative test metal samples for hardness, malleability, ductility, elasticity, fatique resistance. -Investigate the process, principle and reason for tempering, annealing and case hardening. -Heat treat a project and test results.
Topic B -Measurement and Layout Concept: -Accuracy in measurement for layout is imperative in the production of most products.				
1. <u>Measurement and Layout</u> -There are two basic systems of measurement - English and Metric.		-Use the basic systems of English and Metric measurement.		-Use the basic systems of English and Metric measurement.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
-Wall Charts and Samples	Thermoset - aminos, epoxies, phenolics polyesters, silicones, urethanes. -View structure through a microscope. (Relate to hardness and weight.) -Refer to samples of common plastics.	-Wall Charts and Samples	-View structure when possible. (Relate to hardness and weight.)	-Wall Charts and Samples
	-Comparative test plastic samples for strength, elasticity, texture, odor, effects of flame, ability to transmit light, solubility, feel, etc. -Compare thermoset and thermoplastics. -Perform comparative tests of plastics, using a fluoroscope.	Pamphlets: -*Properties of Perspects* C.I.L. -*How to Work with Plexiglass* Cadillac Plastic	-Perform comparative tests such as elasticity, ductility, malleability, hardness, weight, color, and abrasive qualities on earth products.	
-Decimal Equivalent Chart	-Use the basic systems of English and Metric measurement.		-Use the basic systems of English and Metric measurement, i.e. lineal, volume, proportions.	

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
Measurement and Layout (Cont'd.) -Layout and measuring tools provide man with a means of setting down, organizing, and communicating ideas in an industrial society. -The successful completion of a product depends on the choice of materilas and accurate layout and measurement.		-Learn the proper identification and use of tools related to the woods area.		-Learn the proper identification and use of tools used in the metals area.
		-Become familiar with design and layout procedures.		-Become familiar with design and procedures.
				-Use layout die. -Be able to interpret a chart of fractions and decimal equivalents.

Topic C. -Shaping
Concept: -Man manipulates materials, tools and equipment to shape and form products of his environment.

1. <u>Cutting</u> -Most cutting tools employ the wedge to separate materials. -Machines have relieved man of toilsome work, and speeded up production.		-Examine all the cutting tools and machines in the area to determine the cutting principle that is most common.	-Stanley Charts -Workmen's Compensation Safety Charts	-Examine all the cutting tools and machines in the area to determine the cutting principle that is most common.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
-Starrett Wall Charts	-Learn the proper identification and use of tools related to the plastics area.		-Learn the proper identification and use of tools related to the earths area.	
	-Become familiar with design and layout procedures.		-Become familiar with design and layout procedures.	
-Disston Tool Wall Charts 1. Files 2. Hacksaws -Workmen's Compensation Safety Charts	-Examine all the cutting tools and machines used in the area to determine the cutting principle that is most common.	-Pamphlets: *Machining Perspects* *Shaping Perspects* C.I.L.	-Examine all the cutting tools and machines used in the area to determine the cutting principle that is most common.	

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
Cutting (Cont'd.) -Tools are an extension of man's faculties. Cutting tools provide man with mechanical advantage and control.		-Be familiar with the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process.		-Be familiar with the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process.
-Cutting can be accomplished by mechanical, abrasive, thermal, chemical, (etching) electrical (EDM) and optical (laser) means.		-Comparative test the operation of hand and machine tools (e.g., speed, efficiency, effort and quality of workmanship).		-Comparative test the operation of hand and machine tools (e.g., speed, efficiency, effort and quality of workmanship).
-Decreasing the area of the apex of the cutting edge proportionally reduces the power required to drive the edge into the material.		-Use as many of the cutting tools as possible. Be sure to know their proper use and safety precautions, e.g., ripsaw, crosscut saw, planes, chisels, files, drills, boring tools, and abrasives.		-Electro-chemically etch a metal product. -Use as many of the cutting tools as possible. Be sure to know their proper use and safety precautions, e.g., hacksaw, chisel, files, drills, taps and dies.
-A cutting edge must be of a harder material than the material being cut by that edge.		-Use as many of the cutting machines as possible. Be sure to know their proper use and safety precautions, e.g., lathe drill press, sander, portable drill, circular saw, jointer. -Sharpen one type or cutting tool.		-Use as many of the cutting machines as possible, e.g., engine lathe, sharper, mill, drill press, grinder, shear, portable drill. Be sure to know their proper safety precautions. -Sharpen one type of cutting tool.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
-RPM and Cutting Speed Charts (Prepared by teacher)	-Be familiar with the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process.		-Be familiar with the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process.	
	-Comparative test the operation of hand and machine tools (e.g., speed, efficiency, effort and quality of workmanship).		-Comparative test the operation of hand and machine tools (e.g., speed, efficiency, effort and quality of workmanship).	
-Popular Science November 1968 -South Bend Wall Charts 1. Lathe 2. Tap and Drill Sizes -Stanley Safety Charts	-Use as many of the cutting tools as possible. Be sure to know their proper use and safety precautions, e.g., saws, planes, files, drills, taps and dies, snips, shears, scraper, abrasives.			
-Audio-Visuals Branch 1. Lathe work 2. Drill Press 3. Chuckwork	-Use as many of the cutting machines as possible. Be sure to know their proper use and safety precautions, e.g., machine lathe, drill press, portable drill, band saw, metal shaper, mill, sander, polisher.		-Use as many of the cutting machines as possible, e.g., jiggering. -Be sure to know the proper use and the safety precautions for cutting tools and equipment. -Drill a hole in glass. -Cut glass (optional).	-Simple Machine Lever

Systems or Processes	Time	Students Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
2. <u>Shaping</u> -Removing Material The removal of materials for the purpose of shaping can be accomplished by applying the principle of the wedge.		-Use the cutting tools and machines that remove material, e.g., lathe, lathe tools, saws.		-Use the cutting tools and machines that remove material, e.g., metal lathe, hacksaw, lathe tools, milling machine.
3. <u>Molding</u>		-Discuss extrusion molding of particle board.		-Know how metal can be formed by the explosive process. -Discuss extrusion molding of metals.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
	-Know the principles of mechanical shaping and make a product using this method. -Use the cutting tools and machines that remove material.		-Use a potter's wheel for simple jiggering. -Use a potter's wheel for simple throwing. (Optional)	
	-Know what kind of porducts can be used in the molding process. -Know how and what kind of products can be molded by foaming styrene beads, extrusion injection, transfer. -Make products using as many of the molding processes as possible. -Procedure for preparing molds for production. -Make a fibre glass product with hand layup. -Make a fibre glass product using matched molds. -Compression mold with thermoset plastic.		-Use a mold to make a concrete product. -Make a clay product using a mold. -Discuss extrusion molding of glass. -Dry press steatite to form ferrites for electrical insulators. -Dry press silicon carbide abrasives.	

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
4. <u>Forming</u> -Materials may be readily formed or shaped after the application of heat and/or pressure. -Methods of forming materials permanently have extended the usefulness of the material.		-Bend wood for laminating. -Read about another method of of forming materials permanently. Compare the two methods, e.g., soak bending, steam bending.		-Understand the process and application of stamping. -Understand the process and application of forging. -Stretch form copper by hammering it over a die or sand bag. -Use jigs and blocks for bending -Use the bending equipment available in the lab, e.g., box and pan break, metal former. -Twist bar stock. -Know the factors involved in bending, e.g., thickness, type of material, degree of bend, type of bend.
5. <u>Casting</u> -Shape of material can be changed. -Materials, when in a liquid form, can be shaped without the use of force.				-Be familiar with foundry procedures. -Understand the process and application of casting. -Cast a product using a material such as cerebond, aluminum, lead.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
Di-Acro Charts	-Know the principles of free forming and make a product using this method. -Know the principles of vacuum forming and make a product using this method. -Know the principles of blow forming and make a product using this method. -Know how to use all thermoforming equipment safely. -Know the heats required to bend thermoform plastics. -Use the strip bender. -Use a bending jig.	-Film: *Forming Plastic Sheet Materials* Robert Morse Corporation	-Understand how glass can be shaped. -Bend glass tubing. -Anneal glass.	
	-Know what kind of plastics can be cast. -Know how and what kind of products can be made by casting. -Cast a product. -Do rotational and/or slush casting.		-Use a slip mold to cast a product. -Cast concrete in a mold.	

Topic D. -Fabrication
Concept: -Materials of similar or different properties and composition can be fastened by various methods.

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
1. Mechanical		-Know how and when to use mechanical fasteners properly such as nails, screws. -Know types and uses of clamps.		-Know how and when to use mechanical fasteners, e.g., rivets, bolts, self-tapping screws.
2. Adhesion		-Discuss types of glues. -Know proper gluing procedure. -Use laminating process.		-Soldering procedure. -Brazing procedure.
3. Cohesion				-Spot welding procedure. -Forging procedure.
4. Comparative Testing		-Compare the above fastening methods by such criteria as speed, holding power, cost, appearance and permanence.		-Compare the above fastening methods by such criteria as speed, holding power, cost, appearance and permanence.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
-Audio-Visuals Branch 8 *Fastening Devices* TK2161	-Know how to use mechanical fasteners in plastics. Use at least one method in a product. -Test the holding power of various mechanical fasteners in plastics.		-Know how concrete can be strengthened e.g., bolts, reinforcing steel, etc.	
	-Use epoxy cement as a bonding agent. -Test holding power of epoxy cement. -Laminate using solvents.	-Pamphlet: *Cementing Perspects* C.I.L.	-Be familiar with types of porcelain enamels. -Know porcelain enameling procedure and apply it to a product. -Study a grinding wheel and see how the abrasive is bonded.	
	-Know how to use solvents as a bonding agent. -Know how to weld plastics. (Test joints used. Laminate using heat and pressure. (plastic fussion) -Coat paper with plastic.		-Know the various types of glazes. -Know glazing procedure. -Apply a glaze. -Compare glazing process to refactory process. -Apply porcelain enamel to a blank.	
	-Compare the above fastening methods by such criteria as speed, holding power, cost appearance and permanence.		-Compare the above fastening methods by such criteria as speed, holding power, cost, appearance and permanence.	

Topic E. -Finishing
Concept: -Finishes are applied for the purpose of beauty, protection and sanitation.

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
1. Natural				
2. Coatings -The value of a product is enhanced by the quality of its finish. -The appearance and durability of materials can be changed by the application of finishes.		-Discuss reasons for finishing. -Know safety precautions. -Understand the factors involved in finishing, e.g., cleanliness, temperature, humidity. -Discuss preparation for finishing.	-Information Sheet -C.I.L. Filmstrips 8	-Discuss reasons for finishing. -Know safety precautions. -Understand the factors involved in finishing, e.g., cleanliness, temperature, humidity. -Discuss preparation for finishing
-Hand Finishing		-Paint, using a brush. -Apply oil finish with a cloth. -Discuss primers, fillers, waxes.		-Discuss brush-painting procedure. -Discuss use of primer coat.
-Spray Finishing				-Spray paint, using spray cans.
3. Mechanical Finishing		-Know finishing procedures such as sanding, polishing, buffing. -Study types of abrasives.		-Know finishing procedures such as sanding, polishing, buffing. -Study types of abrasives.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
	-Discuss reasons for finishing. -Know safety precautions. -Understand the factors involved in finishing, e.g., cleanliness, temperature, humidity. -Discuss preparation for finishing.		-Discuss reasons for finishing. -Know safety precautions. -Understand the factors involved in finishing, e.g., cleanliness, temperature, humidity. -Discuss preparation for finishing. -Study ways of sufface decorating using porcelain enamels.	
	-Know finishing procedures such as sanding, polishing, buffing. -Study types of abrasives.		-Know finishing procedures such as sanding, polishing, buffing. -Study types of abrasives.	

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
Mechanical Finishing (Cont.'d)		-Know when to use the various types of abrasives.		-Know when to use the various types of abrasives. -Peen a surface.
4. Chemical Finishing		-Surface decorate by using chemicals, such as a bleach.		-Color metal by chemical action, e.g., potassium sulphide for antique work. -Surface decorate metal by chemical action, e.g., etching.
5. Heat Finishing				-Surface decorate metal by heat.
Comparative Testing		-Examine some of the prefinished wood materials available. -Finish wood by several methods and compare the results of finishes by criteria such as appearance, durability, resistance to strain or acid, ease of application, cost.		-Compare the results of finishes by criteria such as appearance, durability, resistance to strain or acid, ease of application, cost.

Topic F. -Educational and Occupational Projections
Concept: -A productive society must prepare its youth to make realistic vocational choices.

1. Guidance - -There are many job opportunities for highly skilled persons.		-Study and prepare a report on: -lumbering - logging, sawing, seasoning processes, conservation.		-Write a report on senior and post high school programs in the metals field.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
	-Know when to use the various types of types of abrasives.		-Know when to use the various types of abrasives. -Smooth glass edges.	
			-Project a picture onto a product. (Optional)	-Kodak
			-Fire polish edges of glass tubing.	
	-Compare the results of finishes by criteria such as appearance, durability, resistance to stain or acid, ease of application, cost.		-Compare the results of finishes by criteria such as appearance, durability, resistance to stain or acid, ease of application, cost.	
	-Write a report on high school or post high school training programs for plastic technology.		-Study development of occupations related to the earths' industries.	

Systems or Processes	Time	Student Experiences and Activities in *WOODS*	Instructional Media	Student Experiences and Activities in *METALS*
Guidance (Cont.'d) -Our society depends on highly skilled labor and division of labor. -Technologists require training beyond the high school level. -The organization and management of business enterprises is an important element in a productive society.		-List occupational areas related to woods. -Take a field trip. -Select one occupation in woodworking and list its job specifications, e.g., education required, vocational training, experience.	-Pamphlets: Check with Counselling and Guidance Office	-Study and prepare a report on: •One industry •Job opportunities within that industry •The specifications of one specific job within the chosen industry. •List occupational areas related to metals area. -Take a field trip

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Walker, John R., *Modern Metalworking*, General Publishing, 1965.

Instructional Media	Student Experiences and Activities in *PLASTICS*	Instructional Media	Student Experiences and Activities in *EARTHS*	Instructional Media
-Pamphlets: Check with Counselling and Guidance Office	-Find out what jobs are available in the plastics industry and know the educational requirements for these jobs.	-Pamphlets: Check with Counselling and Guidance Office	-Learn about occupational opportunities in earths' industries. -Take a field trip. (If possible at beginning of unit). -Prepare a report on a topic suggested by the teacher.	-Pamphlets: Check with Counselling and Guidance Office

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E L E C T R I C I T Y

INTRODUCTION

Space exploration, which satisfies man's thirst for probing the unknown, and automation, which is producing more leisure time as well as a high standard of living, would not be possible were it not for the extensive use of electrical energy. Automation is becoming more apparent in all parts of the economy, urban as well as rural. It is playing an increasing role in industry, and therefore some knowledge of electricity will be necessary in all occupations. Students in the junior high school should be exposed to exploratory experiences in electricity which will help them interpret a productive society, reinforce and synthesize the academic disciplines, and serve in some cases as a measure of guidance to them in planning for their future.

As much activity and experimentation as possible should be provided in each unit. Construction of products which require a great deal of time but illustrate possibly only one electrical principle should be avoided. Rather, the activities should be such that an optimal number of electrical concepts are involved.

SPECIFIC OBJECTIVES

1. To develop an interest in and to recognize the importance of electrical systems used in a productive society.

2. To develop an understanding of the basic electrical principles of these systems and of the individual sections within these systems.

3. To acquaint students with electrical and electronic test equipment, symbols and diagrams.

4. To develop safety habits and attitudes while working with electrical and electronic equipment and materials.

SUGGESTED APPROACH

In a multiple-activity program the student must be able to do a considerable amount of work by following written or printed instructions. It is essential that related information, experiments, and instruction sheets which are given to the student be clearly written. It is also essential that suitable check points be written into the program so that the student's progress can be quickly evaluated before he proceeds from one job to another.

The basic prodecure will be the same as that suggested for all units. Some specific suggestions for this unit include the following:

1. Careful demonstrations on the use of meters are essential.

2. Beginning experiments should use one-function meters of the proper range.

3. Limit the variables tested in a circuit, e.g., in a fixed circuit, test variable sources; using a fixed source, change the controls and/or loads.

4. Use the V.T.V.M. and the oscilloscope if time permits.

5. The use of a product, whether individually produced, mass-produced or co-operatively developed, creates strong motivation for learning the concepts introduced.

C O U R S E C O N T E N T

Topic A. -Uses of Electricity
Concept. -The conversion, application and control of energy is basic to the development and perpetuation of a technological society.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Heating -Heat is produced when the speed of molecular movement is increased. -Induction heating (discharge tubes and electric arcs).		-Experiment with a heating element. -Investigate use of electricity for producing heat in: •the home •manufacturing •construction •medicine -Learn to use the ohmmeter to measure resistance. -Make a small induction heater. -Use the spot welder to make an arc. -Read about conization.	-Page 46, *The Silent Energy* -Pages 51-57, *The Silent Energy*
2. Lighting -Rapid molecular movement in solids, (liquids) or gases produces light.		-Identify parts and circuit of a light bulb. -Describe how a flourescent tube works. -Measure intensity of light with a light meter. -Suggest examples of the use of light in the home, construction, medicine, transportation. -Read a biography of Edison.	-Pages 49-51, *The Silent Energy*

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
3. Motor (magnetic induction) -Electron movement resulting from induction produces mechanical energy.		-Do experiment with induction coils and galvanometer. -Do experiment with loop of wire and magnets to show principle of motor. -Identify parts and function of the electric motor. -Run simple motor. -List uses of electric motors in: •home •transportation •construction •communication •medicine •manufacturing	
-Servo-Mechanisms		-Explain how a servo-mechanism is used to keep a ship or plane on course.	-Pages 43-46, *The Silent Energy*

Topic B. -Safety
Concept: -Safe attitudes and knowledge of proper procedures in the use of equipment and materials is vital to man's survival.

1. Machines -Most current-run machines can be dangerous unless adequately grounded.		-Check motor run equipment for adequate grounds. -See film on electrical safety. -Make list of safety rules for working with electrical equipment.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
2. Clothing -Protective clothing or shielding devices are necessary for certain operations.		-Use of insulated clothing, gloves or boots when working with current. -Use eye protection when working with intense light.	

Topic C. -Sources of Electricity
Concepts: -1. Electrical energy can neither be created nor destroyed but can be changed in form.
-2. Variables governing electron movement can be detected and/or measured.

1. Friction Machine -Electrical energy can be produced by friction.		-Do experiment with comb and paper bits. -Do experiment with glass rod and pitch ball. -Produce electric charge with static machine or electroscope.	
2. Generator -Electrical energy can be produced by magnetic induction.		-Run the generator and measure the current produced. -Identify the parts and study the difference between the generator and the motor. -Learn to use the ammeter.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
3. Crystal Cartridge -Electrical energy can be produced by pressure.		-Do experiment with phono cartridge to evaluate increase in strength of signal. -Study operation of crystal microphone. -Make crystal set.	
4. Solar Cell -Electrical energy can be produced by light.		-Measure current produced by photo cell. -Draw diagram of a photo-voltaic cell and describe how it works. -List examples of the uses of photo-voltaic cells. -Design a circuit, using a photo-voltaic device.	
5. Thermocouple -Electrical energy can be produced by heating two dissimilar metals in contact with each other.		-Make a thermocouple by twisting together two wires of different metal, e.g., iron stove wire and copper wire -Measure current produced by a thermocouple. -Study the circuit of a thermostat on a house furnace.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
6. Batteries -Electrical energy can be produced by chemical reactions.		-Make a battery. -Learn the parts and materials required in a dry cell battery. -Wire batteries in series and parallel and compare voltages. -Learn to use the voltmeter.	
7. Thermo-Electric Generator		-Study the production of electricity with semi-conductors.	-Page 102, *The Silent Energy*
8. Fuel Cells		-Explain the production of electricity with the fuel cell.	-Page 113, *The Silent Energy*

Topic D. -Controlling Electric Energy
Concept: -Electron movement can be controlled and manipulated.

1. The Circuit -Electron current can be directed in predetermined circuits.		-Make a simple series circuit. -Study control devices that may be used to stop or start electron flow: • switches • breakers • relays • fuses • photo cells.	-Pages 22-29, *The Silent Energy.*

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
The Circuit (Cont'd.)		-Control devices that decrease or increase electron flow: •resistors - rheostat •capacitors •coils. -Control devices that change the value of current in relation to voltage: •transformers •coils. -Study a complete transmission and generation system from dam or plant to the home.	
2. Series Circuits		-Experiment with various series circuits. -Develop experiments to illustrate Ohm's Law. -Use measuring instruments to compare values.	
3. Parallel Circuits		-Experiment with various parallel circuits.	
4. Telephone Circuit		-Set up a telephone circuit. -Identify units and functions.	-Page 91-96, *The Silent Energy*
5. Telegraph Circuit		-Make a morse code sender. -Identify parts and type of circuit.	
6. Teletype Circuit		-Compare with telegraph circuit. -List advantages.	

Topic E. -Educational and Occupational Projections
Concept: -A productive society must prepare its youth to make realistic vocational choices.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Guidance -Industrial Arts courses provide a student with a background of many experiences which can be helpful in selecting a more realistic high school program.		-Investigate job opportunities in electrically oriented fields. -See a film on occupations in electricity. -Tape an interview with an electrician and play back to the class. -Prepare a job qualification list for three different occupations related to electricity.	-Pamphlets: Check with the Counselling and Guicance Office

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E L E C T R O N I C S

INTRODUCTION

Because of automation, the increased use of computers, space exploration, and improved communication systems, electronics has become more and more important to our society. In an exploratory course such as this, it would be impossible to cover all phases of electronics in detail or to make an in-depth study of the circuitry and components involved. To study only some of these, however, would defeat the purpose of the course which should be in keeping with the general objectives of the industrial arts program. Therefore, the purpose is to give the students as much breadth of scope as possible. A broad selection of systems should be examined and their applications in our society emphasized. To do this the student should be given the overall story of the operation of each system first, and then should study the various units that comprise the system. Study of components and detailed circuitry should be done only as time permits.

SPECIFIC OBJECTIVES

1. To develop an interest in and to recognize the importance of electronic systems in a productive society.

2. To develop an understanding of the operating principles of these systems and the functions of the sections comprising them.

3. To acquaint students with the proper use of test equipment.

4. To develop safety habits and attitudes while working with electronic equipment and materials.

SUGGESTED APPROACH

The method of teaching the electronic systems will depend to some extent upon the equipment used. In some cases, systems such as radio receivers and amplifiers can be bought in units which can be put together in various combinations. The approach in such cases would be the assembly of the units into a system. After the assembly, the function of various units would be taught by the teacher or read about by the student. Various experiments should also be performed on this equipment. For example, the power supply filter could be removed to show what its purpose is in the system. In other cases the systems would be complete so that no assembly would be possible and an analytical approach to experimentation would have to be taken. The related information given to the students, should point out commercial and/or other applications of all the systems studied.

The Superhetrodyne radio is to be used as the major teaching system. Other systems may be used as supplementary or evaluative systems.

One product representative of a system may be produced as an individual of class activity.

C O U R S E C O N T E N T

Topic A. -Electronic Systems for Reception and Transmission
Concepts: -1. Intelligence can be converted to and/or obtained from controlled electron impulses.
-2. Electrical energy can be changed to electromagnetic waves that can carry signals through space at the speed of light.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Overview and comparison of function of the following systems: •radio •transmitter •phonograph •P. A. system •computer •video (Optional)		-Use of electronics in our society. -Define the function and purpose of each system. Comparisons should be based on: •power requirements •methods of control •type and method of input, voice, tape, record •type of output.	
1. Superhetrodyne Radio -Intelligence from radio waves can be converted to audible sound.		-Operate a radio by selecting a signal and controling volume. Teacher demonstrates use of oscilloscope to show value and pattern of input signal and output signal. -Students make a block diagram of the units in the receiver: •power supply •amplifier •oscillator •detector.	
-Units in an electronic system are dependent on the integrated components within them.		-Recognize symbols used for components.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Superhetrodyne Radio (Cont'd.)		-Identify and test components: •resistors •capacitors •inductance coils •tubes •transistors. -Practice using test equipment to measure resistance and voltage in teacher approved circuits. Use instruments available.	
2. Transmitters -Audio signals can be converted to radio waves and transmitted.		-Study the operation of a transmitter. -Identify the main sections of a transmitter and draw a block diagram; power supply, oscillator, radio frequency amplifier. -Use low power transmitters to transmit signals.	-Department of Transport pamphlet on low power transmission.

Topic B. -Electronic Systems for Amplification
Concept. -Energy can neither be created nor destroyed, but has the ability to produce action or effect.

1. Phonograph -Audio waves can be converted to a permanent record and reproduced on demand.		-Identify the major parts of the system. -Draw a block diagram, labelling the units: power supply, audio, amplifier, etc. -Trace the reproduction of the sound from the record to audio sound.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Phonograph (Cont'd.)		-Understand the piezoelectric effect. -Build a small amplifier, using printed board, integrated circuit or breadboard. -Test the power of the amplifier. (Calculate the power in watts.)	
2. Public Address System -The sound waves produced by human voices can be amplified by means of electronic circuitry.		-Identify the major units of a P.A. system. -Draw a block diagram and label the parts. -Determine the power rating of the amplifier. -Suggest uses for amplifiers in the home, industry and recreation.	
3. Video Systems (Optional)			

.opic C. -Electronic Systems for Calculators
Concept: -Electronic impulses can be manipulated to perform problem-solving tasks.

1. Computer		-Basic understanding of the operation of simple computers. -Study use and application of binary and octal number systems to computer. Use of number for •data •instruction code.	-Manuals that fit equipment.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Computer (Cont'd.)		-Study methods of "feeding" computer languages assembler, computer, interpreter (APL). -Identify uses of computers in industry and education. -Solve simple arithmetic problems on the computer.	

Topic D. -Educational and Occupational Projections
Concept: -A productive society must stimulate its youth to make realistic vocational choices.

1. Guidance -Industrial Arts courses provide a student with a background of many experiences which can be helpful in selecting a realistic high school program.		-Study job opportunities in fields requiring an electronics background. -Write a paragrapn on the educational requirements of an electronics engineer (or other, student's choice).	-Pamphlets: Check with Counselling and Guidance Office

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V I S U A L C O M M U N I C A T I O N S

INTRODUCTION

The segments of Visual Communications as outlined in the content of this unit refer to that type of communication which is drawn, duplicated or photographed. These include experiences in drafting, duplicating methods and the study of light-sensitive materials.

The importance of graphics in the complex world of today cannot be over-emphasized. Whatever segment of our society we examine: the planning of our homes, the automation and computerization of our industries, the achievements in communications ranging from the local newspaper industry to the satellite Alouette, the beckoning of whatever deeper knowledge may lie outside the circumference of our own planet as we venture out into space, all require some form of graphics in their production.

SPECIFIC OBJECTIVES

1. To develop in the student an appreciation of the importance of graphics in all aspects of a productive society.

2. To develop an appreciation for the many applications of light-sensitive materials in a productive society.

3. To impress upon the student, through practical experiences, the importance of technical design and illustration in a complex technological society.

SUGGESTED APPROACH

The object of this unit is to provide an opportunity for the student to obtain an overall view of Technical Design and Illustration and Light Sensitive Materials. The methods and processes are such that the student can be assigned activities which will heighten his interest and give him a keener insight and better understanding of the concepts involved.

In the section on light-sensitive materials the students start with reporducing their drawings by the suggested copying methods.

Students are introduced to the complete process, from the taking of the picture to its final development. It is hoped that the students' work will include composition and darkroom procedures.

In the technical design and illustration section the stress is on expressing ideas by sketching. Partially completed drawings and exercises can be used to teach concepts. Reading of drawings is important and students should have practice to help them understand and recognize common symbols.

C O U R S E C O N T E N T

Topic A. -Graphics
Concept: -All graphic representation is either by continuous tone or dicotomous process.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. History and Overview of Graphics		-Investigate the development of light-sensitive materials. -Discuss the growing importance of light-sensitive materials. -Discuss the development and importance of technical design and illustration.	
2. Materials		-Investigate the wide range of light-sensitive materials. -Investigate the production of paper and ink. -Make paper if equipment available.	

Topic B. -Light-Sensitive Materials
Concept: -Light-Sensitive Materials provide the means by which the reporduction of printed and pictorial materials can be efficiently performed.

1. Copying Process		-Students learn the principles and operation of: •Diazo method (ammonia developed) •Intermediates, e.g., Van Dyke •Overhead transparencies •Wet and dry copies (Optional).	-Kodak Publications and Ansco Publications

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Copying Process (Cont'd.)		-Students should produce copy, using at least two of the aforementioned methods. -Learn use of camera. -Study camera accessories. -Apply composition to photography.	
2. Photographic Process		-Do contact printing •composition and design of Xmas cards, masks, etc. -Do simple enlarging •exposure tests •darkroom procedures •basic projection controls -Do photo drawing. (Optional)	-Ideas for Xmas cards, slides from Kodak. []
3. Film Processing		-Simulate microfilming. -Study film characteristics -Follow correct darkroom procedures.	-Slides: (Kodak) •*Choosing Your Black and White Film.* [] •*How Film is Made for Your Camera.* [] •*How to Develop Your Film.* []

Topic C. -Technical Design and Illustration
Concept: -Production depends on man's ability to express his ideas in the form of drawings and symbols.

1. Pictorial Representation -Ideas presented pictorially are easy to understand.		-Students should have practice in sketching objects in •isometric •two-point perspective	-Industrial Arts [] Transparencies (Walker)

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
2. Multi-View -Ideas expressed through multi-view drawings can provide more detailed information.		-Students sketch objects in multi-view projection.	
3. Drawing Interpretation -Reading and accurate interpretation of drawings is a necessary function of many activities in society.		-Students learn to read: •dimensions •sectional views •mechanical symbols •architectural symbols •electrical symbols •topographical views.	
4. Instrument Manipulation -Through the use of instruments, drawings can be made quickly and accurately.		-Students use drafting instruments: •the drafting machine •templates •scales, etc., to make simple drawings.	
5. Composition -Good design and composition depend upon: function interest simplicity honesty (FISH)		-Students study methods of composition and principles of design related to: •advertising layout •poster design •photography -The principles of product design above should be used in the practical work as it applies to the topics in this unit.	-Locate newspaper

Topic D. -Educational and Occupational Projections
Concept: -A productive society must prepare its youth to make realistic vocational choices.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Guidance Information -There are many job opportunities for highly skilled persons. -Our society deperds on highly skilled labor and division of labor. -Technologists require training beyond the high school level. -The organization and management of business enterprises is an important element in a productive society.		-List the occupations in your town, di trict or city that require the knowledge studied in this unit.	-Pamphlets: Check with Counselling and Guidance Office

B I B L I O G R A P H Y

VISUAL COMMUNICATIONS:

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G R A P H I C C O M M U N I C A T I O N S

INTRODUCTION

For thousands of years man has been preserving his thoughts in pictures and words; today newspapers, magazines and books provide this kind of communication. In fact, pulp and paper is one of the major products of Canada. Since printing and publishing materials is a leading industry in Canada the graphics section of industrial arts is of considerable importance to students. In this course they should become acquainted with the operations connected with printing and publishing.

OBJECTIVES

1. To develop in the student an appreciation of the importance of graphics in all aspects of a productive society.

2. To develop an appreciation for the many applications of light-sensitive ma erials in a productive society.

3. To develop an understanding of the relationships and the interdependency of the various divisions of labor in the areas of graphic design, process photography, platemaking, reproduction and bindery.

SUGGESTED APPROACH

This is a unit of instruction where there is an opportunity to dramatize the "systems" approach used in the printing industry. To introduce students to the activities of the unit, they are provided with a preprinted master. They print this and then are challenged to produce one of their own.

A simple project such as a personalized letterhead may be chosen as the first individual activity. To do this the student uses one of the methods suggested in the guide to set the type, take a photograph of it, reduce the size, mask it, make the plate and run the master.

Having gone through these processes the student would continue with further detailed printing. The product could be synchronized with the work of other students to produce a brochure or booklet.

SECTION A

Topic A. -Graphics
Concept: -All graphic representation is either by continuous tone or dicotomous process.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. History and Overview of Graphics -There has been a continuous development and improvement of materials and processes for graphic presentation.		-Study methods of printing: •rebel •intaglio •lithography •silk screen -Trace development of printing on a chronological chart starting with Gutenberg. -The following relationships should be understood: •composition •camera •platemaking •press run •bindery -Students should have a basic idea of the total procedure required to produce a printed article before going on to the individual processes.	
2. Materials -Basic graphic materials are continuously being improved to produce better graphic reproductions.		-Study the production and uses of: •aniline dye •inks •paper •stencils •carbon paper •pencils -Students may experiment with the production of a product using one of the above, view a film or make a report.	

Topic B. -Offset Lithography
Concept: -The fact that oil and water do not mix is the basic principle used in offset lithography.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. <u>Offset Reproduction</u> -The offset process has become the most commonly used industrial method of producing printed materials.		-Have students run a preprinted master (memo pads). -Pad the memos. -Examine the offset press and the wall charts. Be able to explain the 'oil and water' concept in terms of equipment.	1. 35 mm. film strip and audio tape- B *"Operation of the Multilith 85".* 2. Single Concept Loop 3. Sequential Pictorial Instruction "Preparation" *Graphic Arts Training in Schools* - A.M. A-M Wall Chart "Offset Principle"
2. <u>Master Preparation</u>		-Prepare direct-image masters, using several methods: •sign press •lettering machine •typewriter •pencil, pen and crayon 'letraset	-*Making a Good Impression on Your Master* - Instruction Sheets -Letraset Instruction Sheets
3. <u>Design</u>		-Design and run direct-image masters for: •posters •club activities •sports activities	-A-M Idea Sheets Clipper Service

Topic C: -The Photo-Offset Process
Concept: -The total system of photo-offset lithography is dependent on the inter-relationship of diversified divisions of work.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. The Photo-Offset Process		-Trace the production flow of a book. Relate activities in I.A. to those in Industry. The inter-relationship of the following areas should be understood: composition camera platemaking reproduction bindery -Students should have a basic idea of the total procedure required to produce a printed article before going on to the individual processes.	-Meeta Video-Tape *"Offset Printing"* -Congoli -Unions -*Graphic Arts Training in Schools* - A.M. -*Preparing Copy for Camera* - A.M.
2. Composition		-Compose a personalized letterhead, using any of the following processes: sign press letraset lettering machine stencil idea sheets	-Instruction Sheet Clipper Service A-M Idea Sheets
3. Process Camera Simulation		-Set up a camera. -Characteristics of Ortho film. -Darkroom Procedures. -Film processing.	-Instruction Sheets

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
4. Masking and Stripping		-Laying out a flat. -Stripping-in the negatives. -Corrections and deletions. -Brownline proofs.	-Cogoli
5. Platemaking		-Fastening goldenrod to plate. -Exposure procedures. -Developing and desensitizing. -Preserving the master.	-Instruction Sheets
6. Reproduction		-Preparing the offset press. -Run the letterhead.	1. 35 mm. filmstrip and tape *"Preparation of the Multilith 85"* 2. Single Concept Super 8 Loop *"Preparation"* 3. SPI - *Multilith Preparation*
7. Bindery		-Use approved bindery methods to assemble material produced. -Study methods of fastening material into books, pamphlets, etc.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Bindery (Cont'd.)		-Understand the meaning of: •trimming •stiching •jogging •perforating •collating •creasing •padding •mechanical binding	
8. <u>Guidance</u> -The student should understand inter-relationship of the diversified Divisions of Work.		-The student should: 1. Know the interrelationship of the five areas in the photo-offset process. 2. Relate the industrial arts activities to those found in industry. 3. Know the divisions of labor within the printing industry. 4. Research local job opportunities, comparative salary and training required. 5. Be familiar with related technical vocabulary.	-*Graphic Arts Training Schools* - A.M. -Meeta Video Tape -Cogoli -A.M. *Graphic Arts Training In Schools* -A.M. *Putting Your School Paper to Bed.* -Cogoli - *Photo Offset Fundamentals*

Topic D. -Light-Sensitive Materials
Concept: -Exploiting varied characteristics of Light-Sensitive Material increases the versatility of the offset process.

1. <u>Composition Through Paste Make-Up</u>		-Simulate paste make-up on translucent paper. -Composition methods.	-A-M Idea Sheets Clipper Service

Systems or Processes	Time	Student Experiences and Activitive	Instructional Media
Composition Through Paste Make-Up (Cont'd.)		-Block out for half-tones. -Design methods using prepared translucent sheets.	
2. Positive Masters		-Positive Master characteristics. -Exposing and developing positive plates. -Use translucents for master preparation. -Run the designed product offset.	-A-M Translucents
3. Reversal Film		-Characteristics. -Exposure and developing methods. -Expose translucent paste make-up onto reversal film. -Plate make and press run.	-Instruction Sheet
4. Orthochromatic Film		-Characteristics. -Contact expose student designed translucent copy onto ortho film. -Plate make and press run. -Contact print greeting cards. -Drop out techniques. -Reversals for silk screening.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
5. Line Color Separation		-Produce suitable copy for line separation. -Composition methods. -Negative registration. -Masking procedure. -Plate making procedure -Transparent inks. -Two-color press run.	-Translucent Separations - 33 mm. Film and Audio Tape ▶< *"Clean-Up of the Multilith 85"* Single Concept Loop SPI *"Clean-Up"* ▶<[8]
6. Projection Control In Enlarging		-Production of prints suitable for half-tones. -Filters. -Control methods.	-Kodak series McCoy-*Practical Photography* -Cogoli - *Photo-Offset Fundamentals*
7. Half-tones		-Introduction to half-tones. -Half-tone theory. -Autoscreen film. -Contact Screens. -Darkroom procedures. -Stripping half-tones for platemaking.	-Kodak Series

Topic E. -Educational and Occupational Projections
Concept: -A productive society must prepare its youth to make realistic vocational choices.

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Guidance -There are many job opportunities for highly skilled persons. -Our society depends on highly skilled labor and division of labor. -Technologists require training beyond the high school level. -The organization and management of business enterprises is an important element in a productive society.		-Investigate opportunities in one of the following: printing photography duplicating -Investigate Vocational Education training opportunities.	-Pamphlets: Check with Counselling and Guidance Office.

B I B L I O G R A P H Y

GRAPHIC COMMUNICATIONS:

Addressograph Multigraph Company, *Teacher's Package*, Edmonton or Calgary.
Cogoli, John E., *Photo Offset Fundamentals*, General Publishing, Toronto, 1967.
Creative Art Service, *The Clipper*, Dynamic Grafts Incorporated, Peoria, Ill.

SECTION B (For use by those schools that have not as yet made the transition to offset equipment).

Topic A. -Topography

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
1. Printing Methods		-Know basic printing methods: •rebel •intaglio •lithography •silk-screen.	
2. Materials - Manufacture		-How paper and ink are produced. -Make paper if equipment available. -Draw map of sources of pulp for paper.	
3. The Printing Process		-Study the layout of California Job Case. -Learn the common terms used in printing. -Use a composing stick. -Learn to read a line of type. -Justify a line. -Tie form in galley. -Make a proof.	
Topic B. Rubber Stamp			
1. Rubber Stamp Production		-Make a matrix for a rubber stamp.	

Systems or Processes	Time	Student Experiences and Activities	Instructional Media
Rubber Stamp Production (Cont'd.)		-Know the materials used and why. -Make a rubber stamp.	

Topic C. -Show Card Printer

1. Show Card Production		-Set up letters on show card printer. -Ink plate. -Print show card. -Clean type, brayer and plate. -Simulated embossing.	-Virkotype-Sears Ltd 10301 - 109 Street Edmonton, Alberta

Topic D. -Educational and Occupational Projections
Concept: -A productive society must prepare its youth to make realistic vocational choices.

1. Guidance		-Prepare a report, using the proper format, on one area within the graphics field: •nature of the work •size and distribution •future •personal requirements •preparation •working conditions •economic returns •occupational relationships •entry into occupation •advantages and disadvantages •sources of further information •opportunities in related fields.	

B I B L I O G R A P H Y

GRAPHIC COMMUNICATIONS:

Hildegrandt, C. W., *Graphic Arts Students Workbook*, Commercial Printers, Edmonton, 1967.

Kagy, F. D., *Graphic Arts*, Goodheart-Wilcox, Ill., 1965.

INDUSTRIAL CRAFTS

INTRODUCTION

As our society becomes more productive more leisure time is available to people. In order to use this leisure time most effectively areas of interest can be established early in life. The units outlines under industrial crafts might well spark a student's interest in the selection of an avocational interest.

SUGGESTED APPROACH

An industrial crafts unit could be used as a fourth area for those teachers with large classes. It could also be used to provide enrichment for the industrial arts program. This can be done by tying leather to the materials units, lapidary to the earths unit, or art metal t the metals and earths units.

The industrial crafts should be taught as are the materials units and not as isolated craft units. The emphasis then will be on tools, materials and processes.

SPECIFIC OBJECTIVES (in addition to those found in Materials)

1. To provide an opportunity for the expression of originality and individual initiative.

C O U R S E C O N T E N T

Topic A. -The Material and Testing
Concept: -The development, testing and effective utilization of a nation's natural and synthetic resources is necessary for a productive society.

Systems or Processes	Time	Student Experiences and Activities in *LEATHER*	Instructional Media
1. Development -Raw materials are refined, processed and reconstructed to make new substances useful to man. -Man depends on many materials to meet the needs of a productive society		-Discuss the processing of hides. -Significant developments in the leather industry.	
2. Sources -Sources of raw materials are widely scattered. -Everyone should help conserve our natural resources for future generations.		-Be familiar with the more common types of leather and their sources. -Discuss conservation of materials.	
3. Identification -All materials can be classified under natural ores, natural fibres or synthetics. -Materials have distinguishing properties and characteristics that dictate the uses to which they can be adapted.		-View structure of various leathers under a microscope. -Compare composition of genuine and synthetic leathers. -Compare various leathers as to prices, uses, appearance, etc.	

Student Experiences and Activities in *LAPIDARY*	Instructional Media	Student Experiences and Activities in *ART METAL*	Instructional Media
-Discuss significant developments in this area.		Discuss significant developments in this area.	
-Discuss conservation of materials. -Mark on a map the sources of the more common stones.	-*Rocks and Minerals* by Zim and Shaffer	-Discuss conservation of materials. •sources of non-ferrous metals •sources of enamels.	
-Note characteristics, properties, texture, color, etc., of the more common types of rocks.		-Identify the more common metals used in art metal.	

Systems or Processes	Time	Student Experiences and Activities in *LEATHER*	Instructional Media
4. Testing -Product research and development is important in a productive society. -Testing materials is an important function of manufacturing.		-Compare genuine and synthetic leathers as to flexibility, wearability, workability. -Compare various leathers as to workability, color, feel, etc.	

Topic B. -Measurement and Layout
Concept: -Accuracy of measurement for layout is imperative in a productive society.

1. Measurement and Layout -There are two basic systems of measurement, i.e., English and metric. -Layout and measuring tools provide man with a means of setting down, organizing and communicating ideas in an industrial society. -The successful completion of a product depends on the choice of materials and accurate layout and measurement.		-Illustrate the two basic systems of measurement, i.e., English and metric. -Learn the proper identification and use of tools in the area. -Be familiar with design and layout procedures. -Illustrate use and development of templates. -Transfer designs to the material being used.	

Topic C. -Shaping and Fabrication
Concept: -Man manipulates materials, tools and equipment to shape and form products of his environment.

1. Cutting -Most cutting tools employ the wedge to separate materials		-Examine all the cutting tools and machines in the area to determine the cutting principles that are most common.	

Student Experiences and Activities in *LAPIDARY*	Instructional Media	Student Experiences and Activities in *ART METAL*	Instructional Media
-Test rocks for hardness. -Discuss what types of rocks are suitable for polishing and cutting, e.g., hardness, color, pattern, fracture.	-Moh's scale of hardness.		
-Use the two basic systems of measurement, i.e., English and metric. -Learn the proper identification and use of tools in the area. -Be familiar with design and layout procedures. -Illustrate use and development of templates. -Transfer designs to the material being used.		-Use the two basic systems of measurement, i.e., English and metric. -Learn the proper identification and use of tools in the area. -Be familiar with design and layout procedures. -Illustrate use and development of templates. -Transfer designs to the material being used.	
-Examine all the cutting tools and machines in the area to determine the cutting principles that are most common.		-Examine all the cutting tools and machines in the area to determine the cutting principles that are most common.	

Systems or Processes	Time	Student Experiences and Activities in *LEATHER*	Instructional Media
Cutting (Cont'd.) -Tools are an extension of man's faculties. -Cutting tools provide man with mechanical advantage and control. -A cutting edge must be of a harder material than the material being cut by that edge.		-Note the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process. -Use as many of the cutting tools and machines as possible. Be sure to know their proper use and safety precautions.	
2. Shaping -Removing materials or separating -The removal of materials for the purpose of shaping can be accomplished by applying the principle of the wedge.		-Discuss the procedure for changing a hide into useable leather of different thicknesses. -Use the cutting tools and machines that remove or separate materials, e.g., bevel point knife, revolving punch, round drive punch, common edger, skife rampart gouger, saddler's awl, thonging chisel, scissors. -Prepare leather for carving and tooling.	
3. Molding		-Discuss how parts of leather shoes are molded.	
4. Forming		-Surface decorate leather by stamping, flat modeling, embossing, stippling, veining, seeding. -Discuss stretch forming of leather, using a die.	

Student Experiences and Activities in *LAPIDARY*	Instructional Media	Student Experiences and Activities in *ART METAL*	Instructional Media
-Note the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process. -Use as many of the cutting tools and machines as possible. Be sure to know their proper use and safety precautions.		-Note the adjustable parts and the way in which adjustments, speed, pressure, direction, sharpness and support affect the cutting process. -Use as many of the cutting tools and machines as possible. Be sure to know their proper use and safety precautions.	
-Use the cutting tools and machines that remove material, e.g., diamond saw, grinders. -Use a dop stick.		-Use the cutting tools and machines that remove material, e.g., saws, grinders.	
		-Procedure of annealing and pickling metals. -Know the procedure and the tools used to beat down metal into a form. -Know the procedure and the tools needed to form metal by raising. -Know the procedure for metal-spinning.	

Systems or Processes	Time	Student Experiences and Activities in *LEATHER*	Instructional Media
Forming (Cont'd.)			
5. Casting			

Topic D. -Fabrication
Concept: -Materials of similar or different properties and composition can be fastened by various methods.

1. Mechanical		-Know how and when to use mechanical fasteners properly, e.g., snap buttons, rivets, eyelets. -Know most common methods of lacing and their procedure. -Know when and how to stitch.	
2. Adhesion		-Be familiar with types of cements. -Know proper cementing procedure.	

Student Experiences and Activities in *LAPIDARY*	Instructional Media	Student Experiences and Activities in *ART METAL*	Instructional Media
		-Surface decorate metal by planishing, fluting, doming, spotting, stamping. -Illustrate the use of jigs for bending materials.	
		-Cast a project, using metal of a low melting point, e.g., cerebond.	
-Anchor stones by mechanical means, e.g., tabs.		-Know how and when to use mechanical fasteners such as rivets, screws.	
-Use epoxy cement as a bonding agent.		-Know cements to use on metals. -Know soldering procedures. -Silver solder a product. -Study types of porcelain enamel. -Know porcelain enameling procedure and apply it to a product.	

Systems or Processes	Time	Student Experiences and Activities in *LEATHER*	Instructional Media
3. Cohesion			
4. Comparative Testing		-Compare the above fastening methods by such criteria as speed, holding power, cost, appearance and performance.	

Topic E. -Finishing
Concept: -Finishes are applied for the purposes of beauty, protection and sanitation.

1. Natural			
2. Coatings -The value of a product is enhanced by the quality of the finish. -The appearance and durability of materials can be changed by the application of a finish.		-Discuss reasons for finishing. -Discuss Safety precautions. -Discuss preparation for finishing. -Understand the factors involved in finishing, e.g. cleanliness. -Dye leather. -Apply finish such as liquid wax, paste wax, oil. -Discuss proper care of leather articles.	
3. Chemical			

Student Experiences and Activities in *LAPIDARY*	Instructional Media	Student Experiences and Activities in *ART METAL*	Instructional Media
		-Spot weld a product.	
-Compare the above fastening methods by such criteria as speed, holding power, cost, appearance and performance.		-Compare the above fastening methods by such criteria as speed, holding power, cost, appearance and performance.	
-Discuss reasons for finishing. -Discuss safety precautions. -Discuss preparation for finishing. -Understand the factors involved in finishing, e.g., cleanliness.		-Discuss reasons for finishing. -Discuss safety precautions. -Discuss preparation for finishing. -Understand the factors involved in finishing, e.g., cleanliness. -Study ways of surface-decorating, using porcelain enamels. -Spray paint, using spray cans.	
		-Color metal by chemical action, e.g., antique.	

Systems or Processes	Time	Student Experiences and Activities in *LEATHER*	Instructional Media
4. Mechanical		-Finish edges of leather project	
5. Heat			
6. Comparative Testing			

Topic F. -Educational and Occupational Projections.
Concept. -A productive society must prepare its youth to make realistic vocational choices.

1. Guidance		-Leather industries in Alberta. -Occupational and leisure time. -Opportunities related to leather work.	

Student Experiences and Activities in *LAPIDARY*	Instructional Media	Student Experiences and Activities in *ART METAL*	Instructional Media
-Study types of abrasives. -Know when to use the various types of abrasives. -Know finishing procedures such as sanding, polishing, buffing.		-Study types of abrasives. -Know when to use the various types of abrasives. -Know finishing procedures such as sanding, polishing, buffing.	
		-Color metal by applying heat.	
-Compare the results of finishes by criteria such as appearance, durability, resistance to stain or acid, ease of application.		-Compare the results of finishes by criteria such as appearance, durability, resistance to stain or acid, ease of application.	
-Mainly of an avocational interest. -Application to geology, jewelry and field stone.		-Mainly of an avocational interest.	

D E V E L O P M E N T A L R E S E A R C H

INTRODUCTION

Industrial arts is a field of study that should be constantly changing if it is to be relevant for a productive society. This means then, that new content and curriculum materials need to be developed and tested on a continuing basis. To allow time for this type of activity, provision was made in the course for a nine-twelve week unit entitled "Developmental Research".

This time-block gives the teacher the opportunity to develop new and experimental materials following the approval of the Supervisor of Industrial Arts and the school principal.

SPECIFIC OBJECTIVE

To develop new curriculum content for junior high school industrial arts.

SUGGESTED APPROACH

The Research unit is not circumscribed by any formal content. The course is entirely developed by the teacher. However, it must be properly documented as a research unit and should be developed using the format of the present guide. THE TEACHER MUST SUBMIT AN OUTLINE OF HIS PROPOSAL TO BOTH THE SUPERVISOR OF INDUSTRIAL ARTS AND THE SCHOOL PRINCIPAL FOR THEIR APPROVAL BEFORE BEGINNING.

A record should be kept of activities done by the students so that an evaluation becomes meaningful.

An evaluation of the unit with possible implications for the curriculum should be submitted to the Supervisor of Industrial Arts at the end of the experimental period.